AMENDMENTS TO THE SPECIFICATION

Please amend the specification as follows:

Page 2, before Line 15, please insert the following text consisting of a heading plus five short paragraphs:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows, diagrammatically, a system for operation of an engine in accordance with the invention;

Fig. 2 is a flow chart of operation of the engine;

Fig. 3 shows the flow chart of Fig. 2 with a further feature of resynchronizing ignition and injection;

Fig. 4 shows a modification of the flow chart of Fig. 3; and

Fig. 5 is a mechanical diagram presenting components of an engine operated in the system of Fig. 1.

Page 2, please replace the consecutive seven paragraphs beginning at line 15 with the following consecutive seven rewritten paragraphs:

The method utilizes the fluctuations in the angular speed which occur in an engine 10 (Fig. 5) which is coasting without ignition and/or fuel supply and which result from the braking of the crank mechanism 12 during the compression phases and a slight re-acceleration during the expansion phases. It is possible to sense these fluctuations by using an incremental transducer 20 whose transducer segments 22 are provided with a specific angular spacing so that the precise angular speed can be determined repeatedly during one rotation from the chronological interval between the triggered signals over the circumference. During the coasting, there are, for example, local maximum values and minimum values in the angular speed which can be assigned to specific transducer segments 22, for example by counting the pulses since the gap of the incremental transducer 20 was last passed. As a result, in addition to the gap, further information is obtained about the angular position of the crank mechanism 12, the assigned transducer element being a different number of segments away from the gap depending on the direction of rotation of the engine 10. The type of the sensor 14 which is used is irrelevant here, it is possible to use both inductive sensors and Hall sensors which interact, for example, with teeth as transducer segments 22, or else it is also possible to use other sensors, for example optically acting sensors which interact with a perforated disk or the like as an incremental transducer, the gap being a closed hole in this case.

After a reversal of the direction of rotation has taken place, the position of the ignition times and, if appropriate, injection times of the fuel supply 18 is preferably resynchronized (bottom

of Figs. 3, 4) with the gap 24 of the incremental transducer 20. This may be expedient in order to compensate positioning errors which may possibly occur during the reversal of the direction of rotation since the number of pulses which are triggered by the transducer segments 22 may fluctuate in the forward direction depending on the number of transducer segments still passed after the early ignition 16 owing to the mass inertia of the crank mechanism 12. As a rule, the synchronization can be already performed during the first rotation in the opposite direction.

Furthermore, the method can be developed in such a way that after the early ignition, a rise in the rotational speed of component 26 is anticipated after a number of sensor signals (sensor 14), the engine being switched off if said rise fails to occur. When the reversal of the direction of rotation is successful, the engine is already strongly accelerated during its first rotation in the new direction of rotation, which can be sensed by the sensor 14 using the incremental transducer 20. This rise in the rotational speed which fails to occur when the top dead center is incorrectly exceeded after the early ignition 16 in the previous direction of rotation can be used as a signal to switch off the engine in order to avoid the situation in which the engine 10 which is still running forward is affected by a completely incorrect ignition time during the subsequent rotation.

The method is particularly preferably used in a two-cylinder engine whose cylinders are arranged offset by 180° on the crank mechanism, the assignment, i.e. the actuation of the ignition 16 and, if appropriate of the fuel injection 18, being interchanged

between the first and second cylinders. It would also be conceivable to change the actuation of the cylinders computationally, but the interchanging provides the particular advantage that in the reverse direction of rotation the gap 24 of the incremental transducer which is usually arranged approximately 90° before the top dead center of the first cylinder with respect to the forward direction of rotation is also at a relatively small angular distance with respect to the ignition process which is then actually taking place in the second cylinder, resulting in advantages for the actuation. In a single-cylinder engine, after the reversal of the direction of rotation it is of course necessary to set the ignition and, if appropriate, the fuel injection to a changed relationship with respect to the position of the gap of the incremental transducer. Under certain circumstances it would also be conceivable to provide a further gap which must not however make it more difficult to determine the position of the crank mechanism in the way previously described.

In multi-cylinder engines, it is possible, depending on the offset of the right-angled bends of the crankshaft 26 which are assigned to the cylinders to change the new assignment after the reversal of the direction of rotation by interchanging the cylinders in pairs or, for example in the case of a three-cylinder engine, the assignment is re-determined with respect to the gap 24 of the incremental transducer.

A further advantage of the incremental transducer 20 is used in one preferred development of the method according to which after

the early ignition is output, the number of transducer segments of the incremental transducer which match the sensor is counted, and when a specific limiting number is exceeded the engine is switched off. This measure which is possible as an alternative or as a supplement to sensing the rise in the rotational speed can also be used for the evaluation to determine whether the reversal of the direction of the rotation of the engine was successful. The gap for the incremental transducer is, as already mentioned generally up to approximately 90° before the top dead center of the piston with respect to the forward direction of rotation. The early ignition is, for example, preferably approximately 50° before the top dead center, i.e. approximately 4 to 5 transducer segments after the gap of the incremental transducer. If the direction of rotation is successfully reversed, the sensor senses considerably fewer segments up to the time when the gap is reached again, even when there are overshoots owing to the mass inertia of the crank mechanism, than when the top dead center is passed with a subsequent 270° rotation of the incremental transducer. If the gap is sensed after a number of sensor pulses in a number approximately equal to a quarter of the overall number of transducer segments, it is possible to assume that a successful reversal of the direction of rotation has occurred.

The subject-matter of the present invention is also a sensor system which permits positions to be sensed using an incremental transducer having transducer segments distributed uniformly over the circumference, and using a sensor. According to the invention, a control logic 28 (FIG. 1) senses cyclical fluctuations in the sensed angular speed during one rotation

which are caused by the compression and expansion phases of the at least one combustion chamber when the engine coasts in a non-driven fashion, and generates information about the angular position of the crank mechanism by assignment of these fluctuations to specific transducer segments of the incremental transducer. It is possible to use such a sensor system, which is suitable for use in various areas, to determine the angular position of a crank mechanism. For the preferred use in a method of the type described above, the incremental transducer 20 preferably has a gap 24 which is preferably formed by shortening or cutting out two transducer segments which provide, in conjunction with the sensor, further information about the angular position of the crank mechanism. By means of the assignment of specific gradients of the angular speed to specific transducer segments and by means of the sensing of the gap in addition to the determining of the instantaneous rotational speed and of the determining of the crank mechanism position, such a sensor system also permits the direction of rotation to be determined precisely since the angular spacing between the transducer segment which is determined and the gap is different depending on the direction of rotation when the two-stroke engine coasts.